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KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1915

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MEDDELELSER FRA KOMMISSIONEN FOR HAVUNDERSØGELSER
SERIE: PLANKTON · BIND I · NR. 12 · 1915

MEDUSÆ, CTENOPHORA AND CHÆTOGNATHI

FROM THE GREAT BELT AND THE KATTEGAT
IN 1909

BY

P. L. KRAMP

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
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I. Medusæ, Ctenophora and Chætognathi collected by the "Thor".

During the time from April 10th to June 27th 1909 the Danish research steamer "Thor" was anchored in the deep channel in the Great Belt east of Langeland, Lat. 54° 55·7′ N., Long. 10° 52·2′ E., ca. 1 mile off Spodsbjerg. At this place the depth of the channel is 35 m. — Every day vertical hauls were made with the Hensen net, as a rule 3 hauls pr. day: Between 9 and 10 o'clock in the morning one haul was made from the bottom to the surface and one haul through the upper water layers only. About 11 o'clock in the evening one haul was made through the upper strata. Altogether, 165 hauls were made, viz. 67 from the bottom to the surface, and 98 through the upper strata, beginning on an average 11 1/3 m below the surface [1]). The net was made of silkgauze Nr. 4. The diameter of the opening was 67 cm, and its area 3526 cm^2.

For details regarding the method of collecting the material see P. L. Kramp: Report on the fish eggs and larvæ collected by the Danish research steamer "Thor" in the Langelandsbelt in 1909. — Meddelelser fra Kommissionen for Havundersøgelser, Serie Fiskeri, Bd. IV, Nr. 5, 1913.

In the same paper is given a short account of the hydrographical conditions. — In the bottom layers of the water the current was almost always running from the north towards the south, in the upper water layers usually from the south towards the north, though not seldom the opposite way. When the current of the surface water had a direction opposite that of the deeper strata, it was easy to determinate the position of the limit between the two layers. But even when all the water layers followed the same direction, there was usually a fairly sharp limit between the deeper salt water and the upper more brackish water, though a thin stratum may be indicated as a boundary stratum. The position of the boundary stratum varied between ca. 10 and ca. 25 m, being found most frequently about 15 m below the surface. — For details see the above mentioned paper and I. P. Jacobsen: Gezeitenströme und resultierende Ströme im Grossen Belt. Meddel. f. Komm. f. Havundersøgelser, Ser. Hydrografi, Bd. I, Nr. 14, 1910.

The Material.

In the material collected the following species of Medusæ, Ctenophora and Chætognathi were found:

Medusæ.

Sarsia tubulosa Lesson.
— eximia Allman.
Hybocodon prolifer L. Agassiz.
Steenstrupia aurata Forbes.
Rathkea octopunctata M. Sars.
Halitholus cirratus Hartlaub.
Eutonina socialis Hartlaub.
Obelia sp.
Aglantha digitalis O. F. Müller, var. rosea Forbes.
Cyanea capillata Linné.
Aurelia aurita Linné.

Ctenophora.

Pleurobrachia pileus O. F. Müller.
Beroë cucumis Fabricius.

Chætognathi.

Sagitta elegans Verrill, var. baltica Ritter-Záhony.
— setosa J. Müller.

[1]) Instruction. — The collection of plancton takes place every week-day between 9 and 10 o'clock in the morning and between 11 and 12 o'clock at night. Only vertical hauls are taken. — The collection with the Hensen net is carried out in the following manner: between 9 and 10 a. m. a vertical haul is made from the bottom to the surface. Then a vertical haul is made through that part of the upper water layers where the specific gravity is below 1·015. — Between 11 and 12 p. m. a vertical haul is made through the upper water layers, beginning at the same depth as the last of the hauls of the morning.

Tabel I. General View of the Material from Spodsbjerg.

Date	Hour	Depth in meters	Current at 30 m	Sarsia tubulosa	» eximia	Hybocodon prolifer	Steenstrupia aurata	Rathkea octopunctata	Halitholus cirratus	Eutonina socialis	Obelia sp.	Aglantha digitalis	Cyanea capillata juv.	Aurelia aurita juv.	Medusæ spec. indeterm.	Pleurobrachia pileus	Beroë cucumis	Sagitta elegans var. baltica	» setosa
10/4	a. m.	35—0	—11	1	11	11	..	6	..	..	1	..	..	..	1	15	..	..	33
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15/4	a. m.	35—0	—24	3	14	..	..	..	..	..	1	..	..	..	..	12	..	1	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16/4	..	..	—16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17/4	10 a. m.	35—0	—12	7	18	8	..	7	..	..	..	..	..	..	1	5	..	..	6
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19/4	a. m.	35—0	—16	30	49	15	..	9	1	..	..	..	..	..	7	7	..	..	4
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20/4	10 a. m.	35—0	—4	8	..	8	..	3	..	..	..	..	..	..	..	16	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24/4	a. m.	34—0	—15	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26/4	10^{20} a. m.	35—0	..	9	4	24	..	26	..	..	3	..	..	1	..	15	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27/4	9^{55} a. m.	35—0	..	9	..	12	..	12	..	..	..	..	..	..	..	3	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28/4	9^{45} a. m.	35—0	..	181	41	152	..	172	..	..	..	6	..	..	4	36	..	..	15
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29/4	10^{10} a. m.	35—0	..	90	23	250	..	181	..	1	..	5	..	1	3	22	..	..	30
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30/4	9^{45} a. m.	35—0	..	12	11	41	..	30	..	..	..	..	..	..	..	3	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1/5	9^{40} a. m.	35—0	..	24	3	73	..	15	..	..	2	2	..	..	3	18	..	..	15
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2/5	9^{40} a. m.	35—0	..	11	3	198	..	20	..	..	7	..	..	..	..	23	..	..	5
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3/5	9^{30} a. m.	35—0	—14	28	5	312	..	75	..	..	15	1	..	..	..	17	..	..	17
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4/5	9^{15} a. m.	35—0	—14	4	..	74	..	32	..	..	..	1	..	..	..	5	..	..	11
	11^{15} p. m.	35—0		30	3	165	..	50	..	..	4	..	..	..	..	14	..	..	10
5/5	9^{30} a. m.	35—0	—6	13	1	104	..	12	..	..	1	..	..	..	..	13	..	..	3
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7/5	10 a. m.	35—0	..	2	..	1	..	..	..	..	..	..	..	..	..	13	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8/5	9^{30} a. m.	34—0	—12	1	..	12	..	..	..	..	..	..	..	..	..	6	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9/5	9^{20} a. m.	34—0	—4	13	3	59	..	8	..	..	..	..	..	..	1	1	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10/5	9^{30} a. m.	34½—0	—13	22	3	241	..	90	..	..	19	..	..	..	..	2	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11/5	9^{30} a. m.	34½—0	—18	28	2	87	..	45	..	..	36	..	..	..	..	11	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12/5	9^{30} a. m.	34½—0	—14	95	11	416	..	90	..	..	36	..	..	..	1	39	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Date	Hour	Depth in meters	Current at 5 m	Sarsia tubulosa	» eximia	Hybocodon prolifer	Rathkea octopunctata	Eutonina socialis	Obelia sp.	Aglantha digitalis	Cyanea capillata juv.	Aurelia aurita juv.	Medusæ spec. indeterm.	Pleurobrachia pileus	Sagitta setosa
10/4	9 a. m.	15—0	—33	1	9	..	..	..	..	..	..	..	..	3	28
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
15/4	..	..	—63	..	..	..	..	..	..	..	..	..	..	..	..
	8 p. m.	15—0		4	5	..	..	..	..	..	..	1	..	..	..
16/4	..	..	—3	..	..	..	..	..	..	..	..	..	..	..	..
	11^{20} p. m.	15—0		7	18	..	3	..	..	..	..	..	..	..	1
17/4	10 a. m.	10—0	16	3	3	..	..	..	..	..	..	..	..	1	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
19/4	a. m.	10—0	49	17	30	1	2	..	..	..	..	..	1	..	1
	11 p. m.	10—0		2	5	1	..	..	..	..	..	..	1	..	1
20/4	10 a. m.	10—0	47	..	1	..	..	..	..	..	..	..	1	..	2
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
24/4	a. m.	25—0	56	7	2	..	..	..	..	..	..	..	..	1	2
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
26/4	10^{15} a. m.	10—0	..	10	1	1	1	..	..	..	..	..	1	1	..
	10 p. m.	10—0		..	..	..	..	..	..	..	..	..	..	..	..
27/4	10 a. m.	10—0	..	..	..	5	2	..	..	..	..	..	..	..	..
	11 p. m.	10—0		..	..	..	..	..	..	..	..	..	..	..	8
28/4	9^{50} a. m.	10—0	..	27	8	28	23	..	1	..	..	..	4	..	8
	10^{15} p. m.	10—0		10	..	..	..	..	..	..	..	..	4	1	10
29/4	10^{15} a. m.	10—0	..	19	7	44	88	2	..	..	..	1	2	2	27
	10^{15} p. m.	10—0		..	1	2	..	..	..	1	..	1	..	..	..
30/4	9^{50} a. m.	10—0	..	3	4	14	4	..	..	1	..	..	..	10	2
	11 p. m.	10—0		..	..	1	..	..	..	..	..	..	..	..	1
1/5	9^{45} a. m.	7½—0	..	7	3	19	6	..	..	..	..	..	2	1	21
	10 p. m.	7½—0		..	..	2	..	..	..	..	..	..	..	..	3
2/5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
3/5	..	..	—15	..	..	..	..	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
4/5	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
5/5	9^{40} a. m.	7½—0	66	11	..	4	3	..	..	..	..	..	5	..	3
	10^{15} p. m.	7½—0		..	..	..	..	..	..	..	..	..	..	..	..
7/5	10 a. m.	15—0	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
8/5	9^{40} a. m.	12½—0	84	1	..	5	..	..	..	..	..	..	..	..	..
	11 p. m.	12½—0		..	..	..	1	..	..	..	..	..	..	..	..
9/5	9^{40} a. m.	12½—0	51	4	..	10	3	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
10/5	9^{40} a. m.	12½—0	38	6	2	..	..	..	..	..	..	..	..	..	1
	11 p. m.	12½—0		11	..	..	1	..	1	..	..	..	..	..	..
11/5	9^{40} a. m.	10—0	—19	4	..	8	1	..	..	..	..	..	2	..	1
	11 p. m.	10—0		3	..	..	..	..	..	..	..	..	..	..	2
12/5	9^{40} a. m.	10—0	11	120	4	2	2	..	..	..	..	..	..	..	2
	11 p. m.	10—0		23	..	..	4	..	..	1	..	..	..	..	..

| | | |

Table I (continued). General View of the Material from Spodsbjerg.

Date	Hour	Depth in meters	Current at 30 m	Sarsia tubulosa	» eximia	Hybocodon prolifer	Steenstrupia aurata	Rathkea octopunctata	Halitholus cirratus	Eutonina socialis	Obelia sp.	Aglantha digitalis	Cyanea capillata juv.	Aurelia aurita juv.	Medusae spec. indeterm.	Pleurobrachia pileus	Beroë cucumis	Sagitta elegans var. baltica	» setosa
15/6	..	..	—8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16/6	9⁴⁰ a. m.	35—0	—12	63	..	..	1	..	..	..	3	..	..	..	..	3	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17/6	9³⁰ a. m.	35—0	—20	40	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18/6	9³⁰ a. m.	35—0	—12	74	..	..	..	..	..	..	..	..	..	..	..	2	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19/6	9³⁰ a. m.	35—0	—24	28	..	..	..	..	..	..	..	..	..	..	..	2	..	..	2
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20/6	10 a. m.	35—0	..	32	..	..	..	..	..	..	1	..	..	..	..	5	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21/6	9³⁰ a. m.	35—0	—10	16	..	..	..	..	..	..	1	..	..	..	..	3	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22/6	9³⁰ a. m.	35—0	—7	28	..	..	..	..	..	1	..	..	..	..	..	2	1	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23/6	9³⁰ a. m.	35—0	—9	32	..	..	..	..	..	..	1	..	..	..	..	3	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24/6	9³⁰ a. m.	35—0	—5	27	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25/6	9³⁰ a. m.	35—0	—9	37	..	..	..	..	..	..	..	..	..	..	..	7	1	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26/6	9³⁰ a. m.	35—0	—6	24	..	..	..	..	..	..	..	..	..	..	..	1	..	..	2
	10³⁰ p. m.	35—0		33	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
27/6	9³⁰ a. m.	35—0	—10	33	..	..	..	..	..	..	..	..	..	..	..	11	..	..	1
	10⁴⁰ p. m.	35—0		48	..	..	..	..	..	..	..	..	..	..	..	13	1	..	..
Total number of individuals				2184	232	5127	4	2594	1	15	1419	25	7	7	89	623	6	3	267

Date	Hour	Depth in meters	Current at 5 m	Sarsia tubulosa	» eximia	Hybocodon prolifer	Rathkea octopunctata	Eutonina socialis	Obelia sp.	Aglantha digitalis	Cyanea capillata juv.	Aurelia aurita juv.	Medusae spec. indeterm.	Pleurobrachia pileus	Sagitta setosa
15/6	..	..	109	..	..	..	..	..	..	..	..	..	..	..	..
	11 p. m.	15—0		..	..	..	..	..	..	..	..	..	..	..	..
16/6	9⁵⁰ a. m.	15—0	69	1	..	..	..	..	..	..	..	..	..	..	..
	10⁴⁰ p. m.	15—0		2	..	..	..	..	..	..	..	..	..	..	..
17/6	9⁴⁰ a. m.	14—0	48	..	..	..	..	..	..	..	..	..	..	..	..
	10⁴⁰ p. m.	14—0		..	..	..	..	..	..	..	..	..	..	..	..
18/6	9⁴⁰ a. m.	14—0	14	2	..	..	..	..	..	..	..	..	..	..	..
	10⁵⁰ p. m.	14—0		1	..	..	..	..	..	..	..	..	..	1	1
19/6	9⁴⁰ a. m.	10—0	—8	2	..	..	..	..	..	..	..	..	..	..	..
	11 p. m.	10—0		..	..	..	..	..	..	..	..	1	..	..	..
20/6	10¹⁰ a. m.	12—0	..	1	..	..	..	..	..	..	..	..	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
21/6	9⁴⁰ a. m.	13—0	17	1	..	..	..	..	..	..	..	..	..	..	..
	11 p. m.	13—0		..	..	..	..	..	..	..	..	..	..	..	..
22/6	9⁴⁰ a. m.	12—0	74	1	..	..	..	..	..	..	..	..	..	..	..
	11 p. m.	12—0		..	..	..	..	..	2	..	..	..	..	..	1
23/6	9⁴⁰ a. m.	13—0	86	..	..	..	..	..	..	..	..	..	..	..	1
	..	..		..	..	..	..	..	..	..	..	..	..	..	..
24/6	9⁴⁰ a. m.	13—0	83	..	..	..	..	..	..	..	..	..	..	..	..
	10⁴⁰ p. m.	13—0		..	..	..	..	..	..	..	..	..	..	..	..
25/6	9⁴⁰ a. m.	13—0	102	1	..	..	..	1	..	..	..	..	..	..	..
	11 p. m.	13—0		..	..	..	..	..	..	..	..	..	..	..	..
26/6	9⁴⁰ a. m.	13—0	109	1	..	..	..	..	..	..	..	..	..	..	..
	10⁴⁰ p. m.	14—0		..	..	..	..	..	..	..	..	..	..	..	..
27/6	9⁴⁰ a. m.	14—0	97	..	..	..	..	..	..	..	..	1	..	..	..
	10⁵⁰ p. m.	13—0		..	..	..	..	..	..	..	..	..	..	..	..
Total number of individuals				442	103	212	172	13	22	3	1	21	30	53	212

The examination of the material was carried out by means of a counting-microscope from LEITZ, Wetzlar. As a rule the whole of the contents of every sample has been worked through under the microscope; in three or four cases only I have constricted myself to study the half part of the sample and multiply the number of individuals by 2. — The number of individuals of the various species in every single sample will be found in the general view of the material, Table I. In the table I have also given the hour at which the haul was made, the depth in meters, and the direction and speed of the current at 30 m and 5 m below the surface; the speed is given in cm pr. sec., the direction from the north towards the south is expressed by means of a —, that from the south towards the north has no sign.

As to the reliability of the figures representing the number of individuals I may state as follows: During the first weeks the groups dealt with in the present paper constituted the bulk of the plancton together with some few Copepoda and Schizopoda; within that period the figures may be considered as almost completely exact. About the middle of May enormous quantities of diatoms (*Chætoceras*) appeared, as also a great number of *Oikopleura*, which impeded the examination to a considerable degree, because these organisms cohere as a thick entangled mass, in which the other items of the plancton are enveloped. It is probable that within this period some individuals of medusæ have been overlooked. Within about a fortnight the diatoms disappeared, while the appendicularians remained all through the month of June, though in fairly small quantities so as not to impede the examination of the medusæ. About the middle of June the quantity of Copepods increased very much, but they rendered no hinderance for the examination. — After all, with the exception of about two weeks at the middle of May, the number of individuals stated in the following may be considered as very nearly accurate.

Remarks on the Identification of the Species.

Older specimens of the two species of *Sarsia* may easily be distinguished from one another. *S. tubulosa* is considerably larger than *S. eximia* and has a long, tubular manubrium which may be stretched far out of the bell cavity; the gonads begin at some distance from the base of the manubrium leaving the proximal part free. *S. eximia* has a short, thick manubrium, surrounded by the gonads in the whole of its length. *S. tubulosa* possess a fairly well marked globular or pointed-conical apical room; in *S. eximia* this room is only indicated by a very low conical or flattened domical projection from the basal room of the manubrium. This difference is recognisable in young specimens also, and as a rule it will be sufficient to separate the two species when other characteristic features are absent. Questionable cases may occur, however, as far as young individuals of *S. tubulosa* may bear a great likeness to *S. eximia*. In such cases I was obliged to refer the specimens to the undeterminated species. — *Sarsia gemmifera* was never found in the material; its occurrence in the Danish waters takes place later in the summer time.

Hybocodon prolifer is distinguished from the species of *Steenstrupia* by the oblique shape of the bell, the vacuolated stomacal peduncle and the shape of the large tentacular bulb, even when the tentacles have been jerked off; finally by the five lines of nematocysts on the exumbrella.

Steenstrupia aurata lacks the apical projection and the apical canal, which are characteristic features for *Steenstrupia nutans*.

Rathkea octopunctata is the only species of the *Margelidæ*, which has been found in the present material. Among the species of *Margelidæ* occurring in this part of the Danish waters only one species might possibly, by a superficial view, be confounded with young specimens of *Rathkea octopunctata*, viz. *Podocoryne carnea*, but *R. octopunctata* is distinguished at once by the possession of more than one tentacle on each marginal bulb and by the bifurcated mouth-arms. Moreover *Podocoryne carnea* has a later occurrence in the area.

Eutonina socialis Hartlaub and *Tiaropsis multicirrata* M. Sars have frequently been confounded. Both are watchglass-shaped and have numerous tentacles and 8 lithocysts containing several concretions, but

Eutonina lacks ocelli while in *Tiaropsis* each of the lithocysts bears a large black ocellus. Moreover *Tiaropsis* has only a trace of a stomacal peduncle while *Eutonina* has a well developed peduncle; in full-grown specimens this peduncle is fully as long as the depth of the bell cavity; in young specimens it is very short. Another difference is that *Tiaropsis* has nearly twice the number of tentacles as a *Eutonina* of the same size, at least, this is the fact within the Danish waters, where *Tiaropsis* does not seem to reach the same size as in the Atlantic. The two specimens of *Tiaropsis* taken by the "Karen" have the following sizes: 5 mm with 152 tentacles and 11 mm with 240 tentacles; specimens of *Eutonina* from the same locality with a diameter of 5 mm have 80—84 tentacles, with a diameter of 9—10 mm ca. 120 tentacles.

Four species of the genus *Obelia* occur in the Danish waters: *geniculata, gelatinosa, dichotoma,* and *longissima.* The corresponding hydroids (which belong to the genus *Laomedea*) are all distributed throughout the Kattegat, penetrating southwards at least into the northern part of the Belt Sea, *Laomedea dichotoma* and *longissima* have also been found in the Baltic. At the present time it is not possible to separate the medusæ of the four species and I shall not try to guess, what species the present specimens belong to.

Aglantha digitalis. — Since VANHÖFFEN[1]) and BIGELOW[2]) have demonstrated, that the number of lithocysts in *Aglantha digitalis* is not constant, *Aglantha rosea* (Forbes) can not be maintained as an independent species; it should be characterized by the possession of 8 lithocysts in opposition to *A. digitalis* which is usually said to have only 4; but according to the above mentioned authors it may be found with 5, 6, 7 or 8 lithocysts without relation to the stage of development. *A. rosea* must be considered as a mere variety of *A. digitalis* distinguished from the forma *typica* by its smaller size only. The identification is thus very difficult and must be carried out exclusively by the stage of development of the gonads in relation to the size of the individual. *Aglantha digitalis* forma *typica* is an inhabitant of the northern seas; with the cold water of the Norwegian Sea it is carried into the Skagerrak and the deep channels of the Kattegat, but it is impossible at present to state anything definitely about its distribution within the Danish waters. *Aglantha digitalis* var. *rosea* has a more southern distribution occurring off the coasts of France and England and in the North Sea, whence it spreads northwards along the west coast of Norway and through the Skagerrak into the Danish waters as far as the western part of the Baltic. It is probable that the specimens from Spodsbjerg all belong to the var. *rosea,* partly because they are very small, yet with fairly well developed gonads in the case of the larger individuals, partly because the forma *typica* hardly penetrates so far towards the Baltic.

Chætognathi. — Two species of *Sagitta* may be expected to occur in the Belt Sea, viz: *Sagitta setosa* J. Müller (= *S. bipunctata* Busk, non *S. bipunctata* Quoy et Gaimard) and *Sagitta elegans* Verrill var. *baltica* Ritter-Záhony. They are easily distinguished by the following characteristics:

Sagitta setosa: small, not exceeding 15 mm; no lateral diverticula from the intestinal tube; ovaries short, club-shaped; seminal vesicles close to the hind fins.

Sagitta elegans: medium-sized, ca. 30—44 mm; lateral diverticula from the intestinal tube present; ovaries lengthened, sausage-shaped; seminal vesicles close to the tail fin.

Occurrence at different Times.

In order to illustrate the variation of the appearance and the time of maximal occurrence of the various species, I have worked up the tables II and III. The tables are based on the material collected by the hauls from the bottom to the surface. Table II represents the average number of individuals pr. m^2 surface within periods of ca. 10 days. The figures have been calculated in the following manner: The entire number of individuals (N) of a certain species collected during a period is divided by the number of hauls made from the bottom to the surface within the same period (T); then we have the average

[1]) VANHÖFFEN: Die craspedoten Medusen des "Vettor Pisani". Zoologica, Heft 67. Stuttgart 1912.

[2]) BIGELOW: Medusæ and Siphonophoræ collected by the "Albatross" 1906. Proceed. U. S. Nat. Mus., Vol. 44. Washington 1913.

number of individuals pr. one haul. The opening area of the net was a little more than one third of a square meter; taking under consideration the different circumstances influencing the capture by hauling up the apparatus, it will usually be allowed, in order to ascertain the number of individuals pr. m² surface, to multiply the catch by three[1]).

$$3 \cdot \frac{N}{T}$$

thus represents the average number of individuals, which at a certain moment occur in a vertical column of water from the bottom to the surface with a transverse area of one m². For instance: during the period May 1st to 10th 148 specimens of *Sarsia tubulosa* were captured by 10 bottom—surface hauls; accordingly the average number of individuals pr. m² surface within this period is

$$3 \cdot \frac{148}{10} = 44{\cdot}4.$$

It will be seen from table II that the ranges of figures vary rather irregularly; especially, in the case of several species, a considerable decrease or a comparatively small increase has taken place within the period May 1st—10th; this is undoubtedly owing to hydrographical or climatological circumstances. In order to eliminate these irregularities I have worked up table III which represents the figures within periods of ca. 20 days. The curves in fig. 1 (p. 11) represent these figures in the case of the seven most common species. Table III and fig. 1 give a plain idea of the time of maximal occurrence of the various species in this part of the Great Belt during the spring of 1909.

Table II. Average number of individuals pr. m² surface within periods of ca. 10 days. Based only upon the material collected by the hauls from the bottom to the surface.

Species	April 10—20	» 21—30	May 1—10	» 11—20	» 21—31	June 1—10	» 11—20	» 21—27
Sarsia tubulosa	29·4	150·5	44·4	157·0	74·0	110·4	115·7	92·7
» eximia	55·2	39·5	6·3	10·0	3·0	0·3	..	..
Hybocodon prolifer	25·2	239·5	371·7	955·3	150·7	14·7	..	..
Steenstrupia aurata	..	..	..	..	..	0·9	0·3	..
Rathkea octopunctata	15·0	210·5	90·6	547·7	59·0	7·8	..	..
Halitholus cirratus	0·6	..	..	..	..	..	..	..
Eutonina socialis	..	0·5	..	0·3	0·3	3·3	..	0·3
Obelia sp.	1·2	1·5	14·4	181·0	128·7	118·5	13·3	0·7
Aglantha digitalis var. rosea	..	5·5	1·2	2·7	0·3	0·3	..	..
Cyanea capillata juv.	..	..	..	2·0	0·3	..	..	..
Aurelia aurita juv.	..	0·1	..	..	..	1·2	0·3	..
Pleurobrachia pileus	33·0	42·0	33·6	40·7	14·3	34·8	15·0	15·3
Beroë cucumis	..	..	..	..	..	0·6	0·3	1·0
Sagitta elegans var. baltica	0·6	..	..	..	0·7	..	..	..
» setosa	26·4	23·0	22·5	25·0	5·7	3·3	2·3	1·7

Table III. Average number of individuals pr. m² surface within periods of ca. 20 days.

Species	April 10—April 30	May 1—May 20	May 21—June 10	June 11—June 27
Sarsia tubulosa	95	98	93	104
» eximia	47	8	1·6	
Hybocodon prolifer	142	648	79	..
Steenstrupia aurata	..	..	0·5	0·2
Rathkea octopunctata	122	317	32	..
Halitholus cirratus	0·3	..	..	..
Eutonina socialis	0·3	0·2	1·9	0·2
Obelia sp.	1·4	94	123	7
Aglantha digitalis var. rosea	3·0	2·0	0·3	..
Cyanea capillata juv.	..	1·0	0·2	..
Aurelia aurita juv.	0·5	..	0.6	0·2
Pleurobrachia pileus	38	37	25	15
Beroë cucumis	..	..	0·3	0·7
Sagitta elegans var. baltica	0·3	..	0·3	..
» setosa	25	22	4·4	2

Sarsia tubulosa. — The number of individuals of this species is fairly constant during the whole time of investigation, though outer circumstances have effected some variations, especially during the first periods (see table II). There is no well marked maximum of occurrence to be discerned. It should be remarked

[1]) See KRAMP: Report on the fish eggs etc., loc. cit. p. 3, and HENSEN und APSTEIN: Ueber die Eimenge der im Winter laichenden Fische. Wissensch. Meeresunters. N. F. Bd. II, Heft 2, Kiel 1897, p. 5.

that during the first time almost exclusively small individuals were found, while towards the end of the time of investigation almost exclusively large full-grown individuals were found.

Sarsia eximia. — At the beginning of the investigations this species was more numerous than *S. tubulosa* (see table II), but the number decreases quickly. By the bottom—surface hauls some few specimens were captured during the month of May and one single specimen on June 6th. Accordingly this species has an earlier appearance than *S. tubulosa.*

Hybocodon prolifer is not very numerous during the first period, but the number increases very rapidly showing a very well marked maximum in the middle of May, followed by a rapid decrease. The last specimens were taken by a bottom—surface haul on June 9th.

Steenstrupia aurata. — Of this species only 4 specimens have been captured, all in June. The species has its maximal occurrence in the Kattegat in July and August.

Rathkea octopunctata is very abundant, though not so numerous as *Hybocodon prolifer.* It is not very common in the first samples, but the number is rapidly increasing towards a well marked maximum in the middle of May, decreasing still more rapidly, the species entirely wanting in the plancton after June 9th. This agrees very well with other statements, according to which *R. octopunctata* in the North Sea and adjacent waters has its maximal occurrence in May and disappears completely during the month of June. In more northern regions its maximal occurrence takes place somewhat later.

Halitholus cirratus. — Only one specimen has been found, on April 19th.

Eutonina socialis. — 15 specimens have been captured, most of them early in June. The 3 specimens from April 29th and the specimens from May 20th and 21st are small, all the other specimens are full-grown.

Obelia sp. has been fairly scarce during the month of April and in the beginning of May; but from about May 10th the number increases very rapidly and during about a month *Obelia* is one of the commonest medusæ in the plancton; early in June it is even the most numerous of them all. Towards the middle of June the number decreases suddenly, though a few individuals have been found as late as June 23rd. A comparison with *Hybocodon prolifer* and *Rathkea octopunctata* will show that the maximal occurrence of *Obelia* has a somewhat later position and a larger duration than in the case of the two other species. — In the autumn (August—October) *Obelia* once more constitutes a main part of the plancton in the southern Kattegat. I do not know yet, whether these shoals from the autumn belong to the same or other species than those which are abundant in the spring.

Aglantha digitalis var. *rosea* has not been found during the first time, but late in April some specimens suddenly appeared; during the month of May the number was constantly decreasing, the last specimen being found on June 3rd.

Cyanea capillata. — Some few young specimens have been captured in bottom—surface hauls about the middle of May.

Aurelia aurita. — Some few young specimens were taken now and then, most at the beginning of June.

Pleurobrachia pileus is fairly common during the whole time of investigation, the number constantly decreasing.

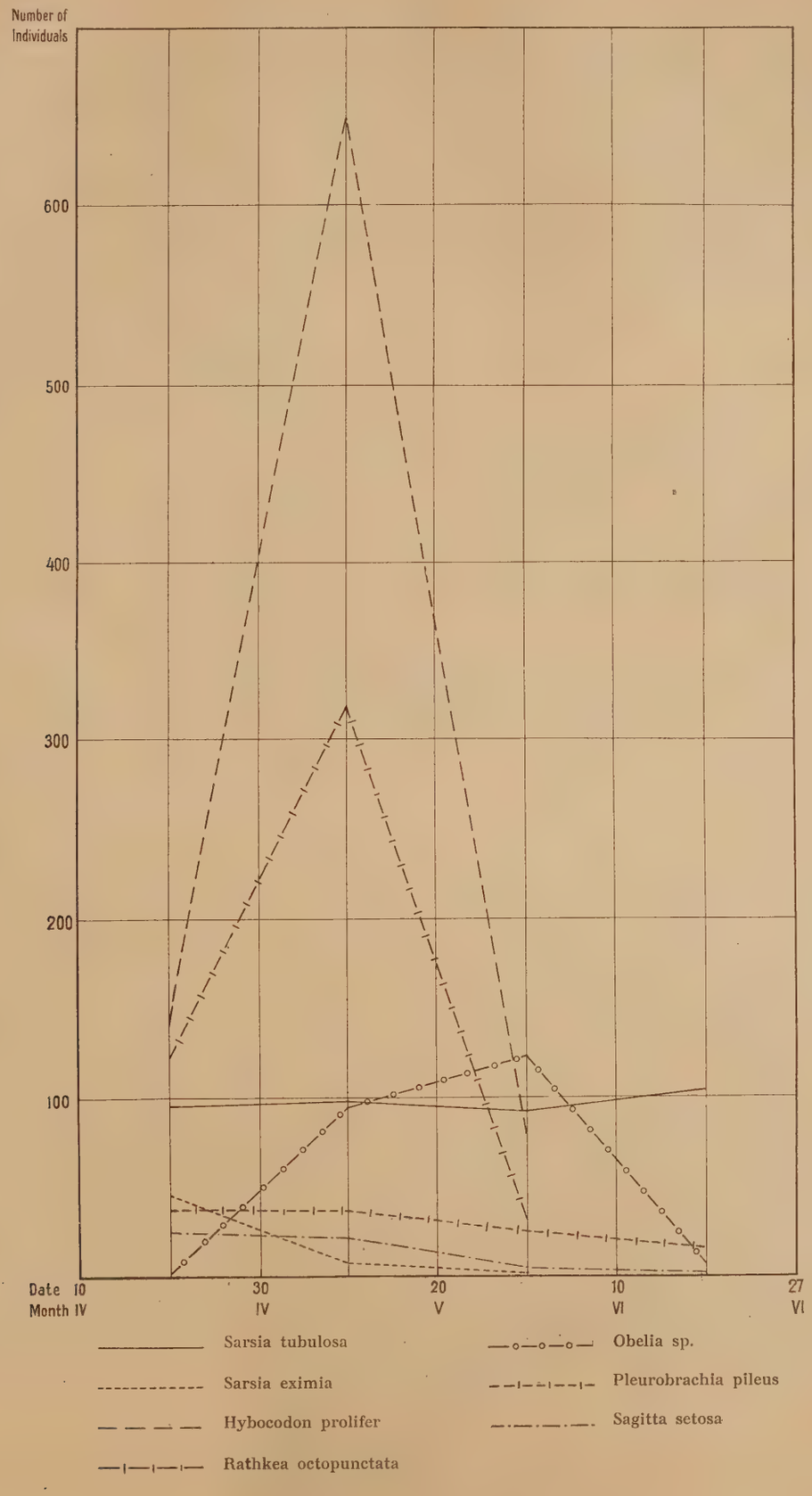
Beroë cucumis has only been found in June; 6 specimens were captured by 6 bottom—surface hauls.

Sagitta elegans var. *baltica* — Only 3 specimens have been taken, one on April 15th, two on May 21st.

Sagitta setosa is most abundant during the first part of the time of investigation, the number being fairly constant to about May 20th, then continually decreasing towards the end of the time of investigation.

Later it shall be discussed how far the different modes of appearance (a well marked maximal occurrence, or a fairly constant appearance during a space of time etc.) bear any connection with other biological habits of the species.

Fig. 1. Average number of individuals pr. m² surface within periods of ca. 20 days (comp. table III).



Occurrence in the different Layers of the Water.

As closing-nets have not been used for these collections, it is difficult to state from which layers of the water the various species mainly have been brought up. We are able to calculate, by means of the opening area of the net used and the depth from which the hauls have been made, the number of individuals of each species which have, on an average, been contained in one m^3 water, partly of the

Table IV, demonstrating the density of individuals in the whole water column compared with the density in the upper strata.

	Sarsia tubulosa	Sarsia eximia	Hybocodon prolifer	Rathkea octo-punctata	Eutonina socialis	Obelia sp.	Aglantha digitalis	Pleurobrachia pileus	Sagitta setosa
Entire number of individuals, caught: by the bottom—surface hauls (n)	2184	232	5127	2594	15	1419	25	623	267
Entire number of individuals, caught: in the upper strata (n_1)	442	103	212	172	13	22	3	53	212
Number of individuals pr. 100 m^3: in the whole water column $\left(\frac{100 \cdot n}{780}\right)$	280·0	29·7	657·3	332·6	1·9	181·9	3·2	79·9	34·2
Number of individuals pr. 100 m^3: in the upper strata $\left(\frac{100 \cdot n_1}{370}\right)$	119·5	27·8	57·3	46·5	3·5	5·9	0·8	14·3	57·3
Relative density of individuals in the whole water column and in the upper strata (approximative fractions)	2·5 / 1	1·1 / 1	11·5 / 1	7 / 1	0·7 / 1	31 / 1	4 / 1	5·6 / 1	0·6 / 1

Table V, demonstrating the density of individuals in the bottom + boundary water compared with the density in the upper strata.

	Sarsia tubulosa	Sarsia eximia	Hybocodon prolifer	Rathkea octo-punctata	Eutonina socialis	Obelia sp.	Aglantha digitalis	Pleurobrachia pileus	Sagitta setosa
Calculated number of individuals: in the bottom + boundary water[1]	1598	95	4844	2365	0	1390	21	552	0
Calculated number of individuals: in the whole of the upper water layer[2]	586	137	283	229	17	29	4	71	283
Number of individuals pr. 100 m^3: in the bottom + boundary water[3]	355	21	1076	503	0	309	5	123	0
Number of individuals pr. 100 m^3: in the upper strata[4]	120	28	57	47	3·5	6	1	14	57
Relative density in the bottom + boundary water and the upper strata (approximative fractions)	3 / 1	0·75 / 1	18 / 1	10 / 1	0 / 1	52 / 1	5 / 1	9 / 1	0 / 1

[1]) $n \div (n_1 + \frac{1}{3} n_1)$. [2]) $n_1 + \frac{1}{3} n_1$. [3]) $100\,(n \div [n_1 + \frac{1}{3} n_1]) : 450$. [4]) $100 (n_1 + \frac{1}{3} n_1) : 330$.

whole water-column from the bottom to the surface, partly of the upper water-layers only. By comparison between the two results we are able to estimate, whether the species mainly occurs in the upper water-layers or mainly in the lower strata; but an exact numerical determination is not practicable.

Table IV has been worked out in the same manner as the corresponding table (V) in my "Report on the fish eggs etc.", to which I refer as regards detailed explanation. — The bottom—surface hauls have filtered ca. 780 m^3 water, the hauls through the upper water-layers have filtered ca. 370 m^3 water. Thus we find the number of individuals of a certain species contained in 100 m^3 water in the whole water column and in the upper strata, respectively:

$$\frac{100 \cdot n}{780} \quad \text{and} \quad \frac{100 \cdot n_1}{370}$$

Table VI. Density of individuals in the different water layers within periods of ca. 20 days.

Period	Number of individuals caught	Sarsia tubulosa	Sarsia eximia	Hybocodon prolifer	Rathkea octo-punctata	Obelia sp.	Pleurobrachia pileus	Sagitta setosa
I April 10—30	bottom—surface hauls	350	171	521	446	5	139	90
	in the upper strata	110	94	97	123	1	19	92
II May 1—20	bottom—surface hauls	619	51	4105	1945	591	234	137
	in the upper strata	238	9	99	46	10	25	93
III May 21—June 10	bottom—surface hauls	590	10	501	203	781	159	28
	in the upper strata	79	..	16	3	9	7	23
IV June 11—27	bottom—surface hauls	625	..	..	...	42	91	12
	in the upper strata	15	..	..	..	2	2	4
	Average number pr. 100 m³							
I April 10—30	in the whole water column	45	22	67	57	0·6	18	12
	in the upper strata	30	25	26	33	0·3	5	25
II May 1—20	in the whole water column	79	7	526	249	76	30	18
	in the upper strata	64	2	27	12	3	7	25
III May 21—June 10	in the whole water column	76	1	64	26	100	20	4
	in the upper strata	21	..	4	1	2	2	6
IV June 11—27	in the whole water column	80	..	..	..	5	12	2
	in the upper strata	4	..	..	..	0·5	0·5	1
	Relative density in the whole water column and in the upper strata .							
I April 10—30	approximative fractions	$\frac{1·5}{1}$	$\frac{0·9}{1}$	$\frac{2·6}{1}$	$\frac{1·7}{1}$	$\frac{2}{1}$	$\frac{3·6}{1}$	$\frac{0·5}{1}$
II May 1—20	» »	$\frac{1·25}{1}$	$\frac{3·5}{1}$	$\frac{19}{1}$	$\frac{21}{1}$	$\frac{25}{1}$	$\frac{4·3}{1}$	$\frac{0·7}{1}$
III May 21—June 10	» »	$\frac{3·6}{1}$	$\left(\frac{1}{0}\right)$	$\frac{16}{1}$	$\frac{26}{1}$	$\frac{50}{1}$	$\frac{10}{1}$	$\frac{0·7}{1}$
IV June 11—27	» »	$\frac{20}{1}$	..	..	..	$\frac{10}{1}$	$\frac{24}{1}$	$\frac{2}{1}$

n being the entire total of individuals collected by the bottom—surface hauls, n_1 the total of individuals collected by the hauls through the upper water-layers. The relative densities of individuals in the whole water column and in the upper strata, calculated from the figures found by the above mentioned method, are expressed by approximative fractions in table IV.

The bottom—surface hauls have filtered 780 m³ water (see above), of which ca. 330 m³ belong to the upper water-layer, whereas the bottom water + the boundary stratum make ca. 450 m³. Table V is based upon these figures, representing a direct comparison between the density of individuals in the bottom + boundary water and the whole of the upper strata (for explanation of details see "Report on the fish eggs etc." p. 23). The approximative fractions in table V give a somewhat more plain idea of the apportionment of the individuals, but it must be remembered, that the figures are approximative and do not give an exact expression of the facts.

Steenstrupia aurata, Halitholus cirratus, Beroë cucumis and *Sagitta elegans* var. *baltica* have never been taken by the hauls through the upper water-layers; these species have not been included in the tables IV and V. — 7 specimens of *Cyanea capillata* have been caught by the bottom—surface hauls, 1 specimen by the hauls through the upper strata. *Aurelia aurita* is represented by 7 specimens caught by

the bottom—surface hauls, 21 specimens taken by the hauls through the upper strata; also these species have been excluded from the tables.

It will be seen from the tables IV and V, that *Sagitta setosa* is a well marked surface species; besides this only *Sarsia eximia* and *Eutonina socialis* are more common in the surface water than in the lower strata.

The other species are more numerous in the lower than in the upper strata: *Sarsia tubulosa, Aglantha digitalis* var. *rosea, Pleurobrachia pileus, Rathkea octopunctata, Hybocodon prolifer* and *Obelia* sp.

Table VI represents the relative density of the various species in the whole water column compared with that in the upper water-layers, calculated in the same manner as in table IV, but within periods of 20 days. In table VI only the most common species have been included. It will be seen that for one and the same species the relative density is not the same during the whole time of investigation. — In table VII the results of table VI have been compared with the results of table III (time of maximal occurrence of

Table VII. Comparison between the results of the tables III, IV and VI (the Roman figures in the table refer to the periods of 20 days).

	Sagitta setosa	Sarsia eximia	Sarsia tubulosa	Rathkea octo-punctata	Hybocodon prolifer	Obelia sp.	Pleurobrachia pileus
Time of maximal predominance (see table VI) { in the upper strata	I	I	..	..	..	..	..
Time of maximal predominance (see table VI) { in the lower strata	..	..	IV	III	II	III	IV
Time of maximal occurrence (see table III)	I	I	IV	II	II	III	I
Maximal occurrence { well marked	—	+	..	±	±	(+)	..
Maximal occurrence { not well marked	..	..	+	..	..	..	+
Relative density in the whole water column compared with the upper strata (see table IV)	0·6 / 1	1·1 / 1	2·5 / 1	7 / 1	11·5 / 1	31 / 1	5·6 / 1

the species) and table IV (the relative density in the whole water column and in the upper strata as regards the whole time of investigation). — It will be seen that in the case of *Sagitta setosa* and *Sarsia eximia,* which are more common in the upper than in the lower strata, the time of maximal predominance in the upper strata is contemporaneous with the time of maximal occurrence (period I). In the case of *Sarsia tubulosa, Rathkea octopunctata, Hybocodon prolifer* and *Obelia* sp., all of which are more abundant in the lower strata than in the upper water layers, the predominance in the lower strata is contemporaneous (or nearly contemporaneous) with the maximal occurrence of the species. *Pleurobrachia pileus,* on the other hand, shows the opposite fact; this species is most common in the lower strata, but the predominance in the lower strata increases very considerably at the same time as the number of individuals decreases.

Relation to the hydrographical Conditions.

The medusæ and ctenophores are very much dependent of the movements of the water; their power of arbitrary locomotion is very small; accordingly the relation to the hydrographical conditions of a certain species is of great value, if we want to know whether it is indigenous to the Belt Sea and the Baltic, or whether it is imported from the Kattegat. In the first case it is probable that most of the specimens will be found in the upper water-layers, the Baltic water, and the variations of the occurrence will show no evident connection to the current and salinity of the water, or the species will be most abundant when the current of the upper strata runs towards the north. On the other hand, if a species has its main occurrence in the lower strata and is found most abundantly when the salinity of the deeper water-layers

is high, it is probable, that the species is imported from the Kattegat or even from the North Sea. But certain results can only be obtained by comparison of these facts with other statements.

Sagitta setosa stands opposed to the medusæ, by the fact that it is a vivacious self-moving animal. It is much more common in the upper water-layers than in the deeper strata; the specimens taken by the bottom—surface hauls have undoubtedly for the most part, perhaps exclusively, been captured in the upper strata (see table IV and V, p. 12). An examination of table I (general view) will show that the occurrence of this species has varied very considerably, periods of abundance interrupted by periods, in which the species was almost absent. A comparison with the figures representing the salinity will show, that the periods, when *Sagitta* was abundant, are contemporaneous with periods of high salinity in the upper water-layers, while very few specimens were found when the salinity was low. After May 22nd *Sagitta* was very rare with the exception of a single small blazing up about June 8th contemporaneous with an unusually high salinity in the upper water-layers. A comparison with the statements of the direction of the current will give a corresponding result: *Sagitta* is common when the surface water current runs towards the south, rare when the current runs toward the north. It is probable, therefore, that the specimens of *Sagitta setosa*, caught in the Langelandsbelt, are imported from the Kattegat, and as it is a well marked surface water species it can only be found at this southern place when the current at the surface has a direction from the Kattegat towards the Baltic.

Sarsia eximia is most common in the upper water-layers. The figures do not show any evident connection between the appearance of the species and the hydrographical conditions, whatever the material is too small, or the species is very euryhaline, or other circumstances have had a disturbing influence on the occurrence of the species during this time.

Eutonina socialis, most common in the upper water-layers. The material is small; most of the specimens have been taken between June 1st and 9th, in which period the surface current was running towards the south and the salinity of the upper water-layers was increasing from a low to a very high degree. This species is undoubtedly imported from the Kattegat.

Sarsia tubulosa, most abundant in the deeper strata, especially towards the end of the time of investigation. The variations from day to day of the number of individuals are very large. A connection between these variations and the hydrographical conditions is slightly indicated, as far as a higher salinity in the lower or the intermediate water-layers seems frequently to be followed by a greater number of *Sarsia*. Probably some of the specimens from Spodsbjerg have been hatched from hydroids growing in the Belt Sea, while other specimens have been imported from the Kattegat (see later).

Pleurobrachia pileus. A relation to the hydrographical conditions is not visible.

Rathkea octopunctata is abundant in the deeper strata from the end of April to the end of May. The number of individuals shows a fairly distinct connection with the salinity at 15 m below the surface during the time about May 1st, later with the salinity at 20 m; the higher degree of salinity the more specimens of *Rathkea* were taken by the bottom—surface hauls.

Hybocodon prolifer. The variations of the number of individuals follow fairly well the variations of the salinity at 15 and 20 m below the surface during the time from the end of April to the end of May, a high salinity being followed by an increasing number of individuals of the species.

Obelia sp. is almost wanting in the upper strata. The number of individuals varies enormeously from one day to the other; during the time from about May 10th to June 2nd these variations follow the variations of the salinity at 20 m very evidently. Accordingly these shoals of *Obelia* are probably imported from the Kattegat.

The other species, dealt with in this paper, have been taken in so small quantities, that nothing can be stated as to their relation to the hydrographical conditions.

II. Medusæ collected by the "Karen".

Towards the end of April the cutter "Karen", hired by the Danish Commission for investigations of the sea, made some collections with a pelagic net in the Great Belt and Kattegat. The net was made of stramin [1]), the diameter of the circular opening was 1 m. At each station two horizontal hauls were made, one haul at the surface and one haul at some distance below the surface, a buoy being tied to the ring of the net by means of a buoy-rope of a certain length in order to keep the net at a certain depth. The duration of each haul was one hour. Such collections were made at 6 stations (see the general view, table VIII). The material from these stations renders valuable additional information to the results obtained by the examination of the Spodsbjerg material dealt with in the foregoing pages. The same species of medusæ were

Table VIII. General View of the Material collected by the "Karen".

Number of Station	Locality	Lat. N.	Long. E.	Date	Depth in meters	Length of buoy rope	Sarsia tubulosa	Sarsia eximia	Hybocodon prolifer	Rathkea octopunctata	Halitholus cirratus	Obelia sp.	Tima Bairdi	Eutonina socialis	Tiaropsis multicirrata	Aglantha digitalis	Cyanea capillata juv.	Aurelia aurita juv.
1253 b	4 miles W 1/4 S of Albuen lighthouse ...	54°49′	10°51′	20/IV	20	0 m	c. 100	c. 25	..	..	..	..	..	..	..	..	..	..
—	—	—	—	—	—	15 m	c. 400	c. 400	..	..	17	..	..	..	..	..	..	12
1253 c	4 miles SE of Kjels Nor lighthouse	54°42′	10°49′	20/IV	20	0 m	c. 12	c. 30	..	..	..	..	..	..	..	..	..	..
—	—	—	—	—	—	15 m	c. 50	c. 70	..	..	2	..	..	..	..	..	..	1
1255	3 1/2 miles NE 1/2 E of Nyborg Church	55°21′	10°52′	22/IV	23-26	21 m	c. 500	c. 1230	2130	628	15	> 6	..	..	..	41	1	23
1261	4 1/2 miles S by W of Hasenöre.....	56°04′	10°42′	25/IV	22·5	0 m	14	14	245	27	..	..	..	..	..	..	..	..
—	—	—	—	—	—	21 m	c. 1800	c. 250	c. 2500	c. 4800	c. 20	c. 20	..	..	..	c. 100	c. 4	c. 40
1267	10 miles E 1/2 S of Als Odde.....	56°43′	10°38′	27/IV	10	0 m	195	?29	58	36	1	..	..	7	..	48	5	1
—	—	—	—	—	—	7·5 m	c. 1000	..	c. 60	c. 40	c. 10	..	..	c. 50	..	c. 2500	c. 5	..
1270	5 miles NNE of Læsö Rende light-vessel..	57°18′	10°43′.5	28/IV	22·5	0 m	77	..	60	17	..	..	..	..	..	11	..	..
—	—	—	—	—	—	19 m	1160	..	800	310	6	+	2	293	2	85	1	..

found with the exception of *Steenstrupia aurata*. Moreover two specimens of *Tima Bairdi* Forbes and two specimens of *Tiaropsis multicirrata* M. Sars were found at stat. 1270 in the Læsö Rende. I shall not enter further into details regarding the material collected, only make some few remarks. — At stat. 1253 b, second haul (with 15 m buoy-rope) altogether 825 specimens of *Sarsia* were captured, about equal numbers of *S. tubulosa* and *S. eximia*; I have, therefore, calculated the number of each species to be about 400. At stat. 1267, the surface water haul, 224 specimens of *Sarsia* were captured; 29 specimens have been referred to *S. eximia* though with some doubt; by the haul with 7·5 m buoy-rope no specimens of *S. eximia* were found. Most of the specimens of *Sarsia tubulosa* from the first five stations were very small. The 77 specimens of *Sarsia* from stat. 1270, the surface water haul, probably all belong to *S. tubulosa;* most of them are small. At the deep water haul at the same station a great number of large specimens of *Sarsia tubulosa* were found. One of the specimens of *Tiaropsis multicirrata* was a mature medusa, diameter 11 mm, the other one was only 5 mm. Of *Eutonina socialis* only young specimens were found, ranging from 1·5 mm

[1]) about 6 threads on 1 cm.

in diameter with 8 tentacles to 10 mm with about 120 tentacles. — Only very small specimens of *Obelia* were found, I am not able, therefore, to state the exact number of individuals. — The specimens of *Aglantha digitalis* from stat. 1255 probably belong to the var. *rosea*, while the specimens from the stations in the northern part of the Kattegat probably belong to the forma *typica*. — In the case of stat. 1261 and 1267, the deep water hauls, I have only counted a smaller part of the individuals, so that the figures used in the general view are only approximate.

III. Summary.

The following is a short review of the results regarding the features of biology of the various species of medusæ in the Great Belt and the Kattegat, as far as they can be extracted from the material dealt with in this paper, compared with a few other experiences. In time, when I have examined larger quantities of material, I hope to be able to give a general account of the occurrence of the medusæ in the Danish waters.

Sarsia tubulosa.

This species is distributed along the coasts of the northern Europe. In the Baltic it is found as far eastwards as in the neighbourhood of Bornholm. Everywhere in the area of distribution it appears in the early spring, is most abundant in May—June, and disappears entirely from the plancton in June—July (in northern regions somewhat later) when the sexual reproduction has taken place. Probably the hydroid, *Coryne Sarsii* is fairly widely distributed within the Danish waters, though until now it has only been recorded from Bohuslän on the west coast of Sweden, from the Little Belt, and from Kiel.

It will be seen from the statements in the foregoing pages that the quantities of *Sarsia tubulosa* caught off Spodsbjerg were nearly the same during the whole time of investigation. During the first time the individuals were small, towards the end of the time almost only large individuals were found. The bulk of the medusæ of this species, hatched in the Kattegat and the Belt Sea, are probably set free in the early spring (about the beginning of April) and grow slowly, reaching maturity in June. But as the quantity of specimens found off Spodsbjerg is nearly constant during a long period, we must believe that a supply of new individuals takes place. Evidently, for the main part this supply is owing not to the hatching of new medusæ from the hydroids growing in the Belt Sea, but to an importation from the Kattegat and the North Sea. This result is plainly seen from the fact that during the first part of the time of investigation a proportionately large number of individuals were taken in the upper strata, while towards the end of the time the bottom—surface hauls contained 20 times the number of individuals as the hauls through the upper strata. And it is confirmed by the material of the "Karen", especially from stat. 1270 (Læsö Rende, April 28th); at this locality some small specimens were found at the surface, possibly originating from hydroids in the Kattegat; on the other hand, 19 m below the surface great quantities of large specimens were brought up, being undoubtedly imported from the Skagerrak.

Sarsia eximia.

Distribution: coasts of northern Europe, Greenland, Alaska. This species was common off Spodsbjerg at the beginning of the time of investigation, but the quantity was quickly decreasing. It was much more common in the upper than in the deeper water-layers, and it shows no evident connection with the

hydrographical circumstances. The species was common at the four southernmost stations of the "Karen" (Belt Sea and southern Kattegat), moreover some specimens, probably belonging to this species, were found at the surface off Als Odde in the northern Kattegat, but is was not found in the deeper water at the same locality and the species was quite absent at the station in the Læsö Rende. There can be no doubt, therefore, but that the numerous specimens found in the Great Belt and the southern Kattegat have been hatched from hydroids growing at the coasts of the Belt Sea or, perhaps, partly in the Baltic. It is curious that the hydroid, *Coryne eximia*, has never been recorded from the Danish waters; recently I have found it in great abundance at Middelfart in the Little Belt, and undoubtedly it occurs at several other localities.

Hybocodon prolifer.

The medusa is distributed along the east coast of North America and off the coasts of the northern Europe. The hydroid has only been found very sparingly. It has never been found in the Danish waters and probably does not occur there, as all facts seem to demonstrate, that the specimens caught in the Kattegat and the Belts have all been imported from the North Sea or have been budded off from the imported specimens. Off Spodsbjerg the species was much more numerous in the deeper layers than in the upper strata, and the variations of the occurrence follow very distinctly the variations of the salinity, most specimens being found by a high salinity. The maximal occurrence is sharply marked off. The fact is, I suppose, that within a comparatively short space of time a great shoal of medusæ is carried into the Kattegat, the number further increasing by budding, at the same time as the shoal is carried further southwards towards the Belt Sea. The main part of the medusæ keep themselves in the deeper, salt water, probably at a short distance below the boundary stratum. — The time of maximal occurrence off Spodsbjerg was towards the middle of May. This agrees quite well with the results of the investigations of the "Karen"; the species was not taken at the two stations (stat. 1253 b and 1253 c) in the southern part of the Great Belt on April 20th, but large quantities were found off Nyborg in the Great Belt on April 22nd and near Hasenöre in the southern Kattegat on April 25th. At the stations in the northern part of the Kattegat it was taken in somewhat smaller quantities. Accordingly: the bulk of the imported individuals of *Hybocodon prolifer* had reached the southern Kattegat and the northern part of the Belt Sea towards the end of April, and was found in the southern part of the Great Belt in the first half part of May.

Steenstrupia aurata.

Four specimens of this species were taken in June in the deeper strata. The hydroid (*Corymorpha aurata* or *nana*) is not known from Danish waters. The medusa was not taken by the "Karen", and the material from Spodsbjerg is too small as a foundation for certain conclusions.

Rathkea octopunctata.

This species occurs off the coasts of Europe from the North coast of Russia to the coast of France. It has also been found in the Mediterranean and the Black Sea. It is abundant in the North Sea, and every spring great quantities are carried into the Kattegat. Nobody has seen the hydroid, but as the medusa has a distinctly seasonal occurrence and is completely wanting in the plancton in the autumn, there can be no doubt of the existence of a hydroid stage. Probably this hydroid occurs in the North Sea, and the main part of the great shoals, which are found in the Kattegat and the Belt Sea in the months of April and May have undoubtedly been imported from the North Sea. But we may not exclude the possibility that the unknown hydroid might occur in the Danish waters and give origin to some of the medusæ found in this area. — The maximal occurrence at Spodsbjerg took place in the middle of May and was sharply defined. The medusa was much more numerous in the deeper than in the upper water-layers, and it was most abundant when the salinity of the deeper strata was high. It was not found at the two

southernmost stations of the "Karen" (near the south point of Langeland), but it was abundant near Nyborg on April 22nd, and enormous quantities were taken near Hasenöre on April 25th. In the northern part of the Kattegat not many specimens were found.

Halitholus cirratus.

This species has been mentioned in the literature under wrong names, partly as *Tiara conifera*, partly as *Tiara pileata*. HARTLAUB has recently carried out a revision of the family *Tiaridæ* and described (Nordisches Plankton Nr. XII, I, 3, 17 Lief.) the new genus *Halitholus* containing the species *H. pauper* n. sp. from Greenland, and *H. cirratus* n. sp. which is distributed partly in the Polar Sea round Spitzbergen and in the Barents Sea, partly in the Baltic and the Kattegat. HARTLAUB also describes a hydroid found in Danzig Bay, considered to be the hydroid stage of this medusa; it has a great likeness to *Perigonimus serpens* Allman, but its identity is not finally stated. HARTLAUB gives a very good and thorough description of the medusa, but he does not enter into a further discussion of its biology. — The medusa is distributed throughout the Baltic as far northwards as Lat. 59° 02′ N., in the Bay of Bothnia; from the western Baltic it penetrates northwards through the Danish Belts and it has been found in the northern part of the Kattegat.

The material from Spodsbjerg contained only 1 specimen of *Halitholus cirratus*, taken by a bottom—surface haul on April 19th. It was taken at all the stations of the "Karen", as much as ca. 20 specimens by one horizontal haul. At stat. 1267 (northern Kattegat) one specimen was taken at the surface; with this exception the species was exclusively taken in the deeper strata. This does not seem to agree with the statement, that the species is indigenous in the Baltic and spreads northwards into the Kattegat. In reality, it was never taken by the "Karen" in the "Baltic water". Possibly the explanation may be found in the fact, that also in the eastern Baltic the species is mainly found in the deeper, more salt water (see HARTLAUB, food-note p. 275). There is no possibility of a confoundation between this species and *Leuckartiara octona*.

Eutonina socialis.

Distribution: the North Sea, Kattegat and Belt Sea. — Off Spodsbjerg 28 specimens were found, young specimens from April 29th to May 21st, mature specimens in June. Most of them were found at the beginning of June at a time when the current at the surface had a southern direction and the salinity of the upper water-layers was high. 13 individuals were taken in the upper water-layers, 15 by the bottom—surface hauls. By the "Karen" a great number of young specimens of this species were found at the two stations in the northern Kattegat, most of the specimens in the deeper strata. HARTLAUB states, that the hydroid corresponding to this medusa is a *Campanulina*. As young specimens have been found in the Kattegat as well as off Spodsbjerg, it seems reasonable that the hydroid may occur in the Kattegat or at least in the Skagerrak.

Tiaropsis multicirrata.

Distribution: northern Europe from Iceland to the North Sea, occasionally carried into the Kattegat. — Two specimens have been found at stat. 1270 in the Læsö Rende, April 28th, by the deep-water haul.

Obelia sp.

As I do not know what species of *Obelia* I have before me, it is useless to discuss common results of the investigation of the material in hand.

Tima Bairdi.

When individuals of this species are found within the Skagen, they have undoubtedly been imported from the North Sea. 2 specimens were taken at the northernmost station of the "Karen", Læsö Rende, April 28th, by the deep-water haul.

Aglantha digitalis.

Probably all the specimens from Spodsbjerg belong to the var. *rosea*. — Some specimens were found at the end of April and during the month of May, mostly in the deeper water layers. The "Karen" caught 41 specimens by the deep water haul near Nyborg in the Great Belt on April 22nd; probably these specimens belong also to var. *rosea*. It is possible on the other hand, that the numerous individuals from the stations in the Kattegat, in any case from the two northernmost stations, belong to forma *typica*, the northern form, which from the Norwegian Sea and the Skagerrak is carried into the northern Kattegat.

Cyanea capillata.

Some quite young specimens of this species were taken off Spodsbjerg at the middle of May by bottom—surface hauls. The "Karen" found one specimen in the Great Belt (at stat. 1255, near Nyborg, April 22nd), and some few specimens in the Kattegat.

Aurelia aurita.

Some few quite young specimens were found off Spodsbjerg in April. During the cruise of the "Karen" young *Aurelia* were found at all the stations except in the Læsö Rende; most of the specimens were found near Nyborg and in the southern Kattegat, almost exclusively in the deeper strata. — Somewhat larger individuals were taken off Spodsbjerg at the beginning of June in the upper strata.

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